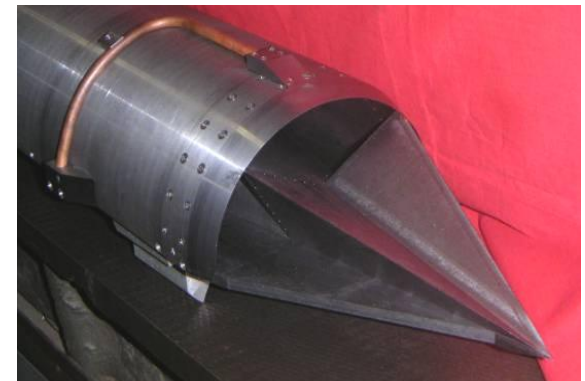
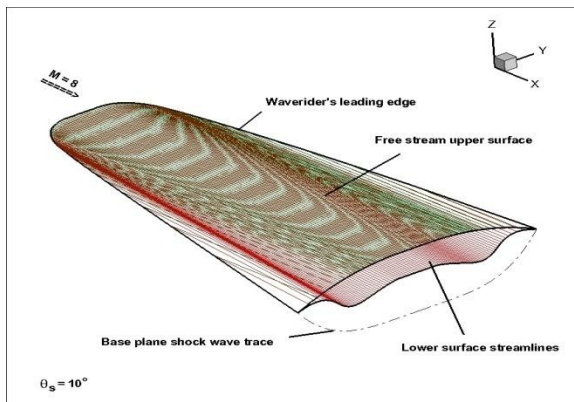


# Statistical Research - Industrial, Academic and Government Collaborations



Carolyn B. Morgan, Ph.D.  
Professor, Department of Mathematics  
Hampton University, Hampton, VA

With significant engineering input  
From Dr. Morris Morgan, III



# Previous Industrial and Academic Collaborations

- Statistician at GE Global Research (1972-1996)
  - ✓ Applied statistical methods to technically significant problems throughout the company (medical systems, GE Profile dishwasher design team, product reliability,..)
  - ✓ Collaborated with Dr. Morris Morgan, chemical engineering professor at Rensselaer Polytechnic Institute with 13 years of prior experience with General Motors, Monsanto and GE Global Research and research projects with Aberdeen Proving Ground
  - ✓ Presented over 20 technical talks on statistical research work at ASA and AIChE national meetings and 15 technical papers

# Current Industrial, Academic and Government Collaborations

- Transitioned to Hampton University in 1996
  - ✓ Chair, Department of Mathematics
  - ✓ Hampton Representative **to Universities Space Research Association** (collaborative membership organization of universities and other research organizations that cooperate with each other, with the United States government, and other entities to develop knowledge associated with space science and technology).
- Initiated interdisciplinary research with the School of Engineering and Technology to provide research opportunities, tuition and stipend support for STEM undergraduates and Applied Mathematics graduate students in the Statistics track

# Statistical Research Presentations

Morgan, C. B. and Morgan, M. H. (2000). *A Statistical Model of the Drag Coefficient in an Engineering Transport System*, **Joint Statistical Meetings**, 2000 Indianapolis, IN (contributed paper).

Morgan, C. B. and Morgan, M. H. (2001). *Modeling the Effect of Cycle Time Distribution on System Performance*, **Joint Statistical Meetings**, 2001 Atlanta, GA (contributed paper).

Morgan, C. B. and Morgan, M. H. (2002). *Time Series Analysis of a Closed-Loop Electro – Spouted Bed*, **Joint Statistical Meetings**, 2002 New York City (contributed paper).

Morgan, C. B. and Morgan, M. H. (2003). *Predicting the Onset of Flow Instabilities Using Time Series Methods*, **Joint Statistical Meetings**, 2003 San Francisco, CA (contributed paper).

Morgan, C. B. and Morgan, M. H. (2004). *Statistical Modeling of Flow Instabilities in an Engineering System*, **Joint Statistical Meetings**, 2004 Toronto, Canada (contributed paper).

Morgan, C. B. and Morgan, M. H. (2005). *Statistical Investigation of Chaotic Data Streams Using a Haar Wavelet Transform*, **ASA Joint Statistical Meetings**, 2005 Minneapolis, MN (contributed paper).

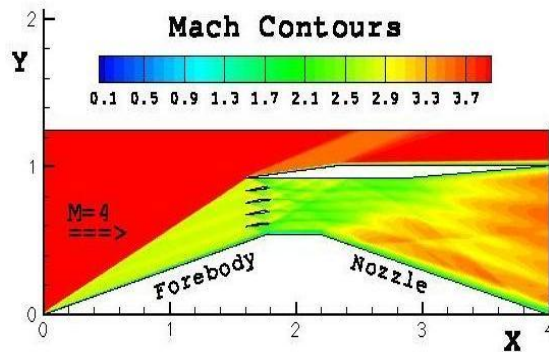
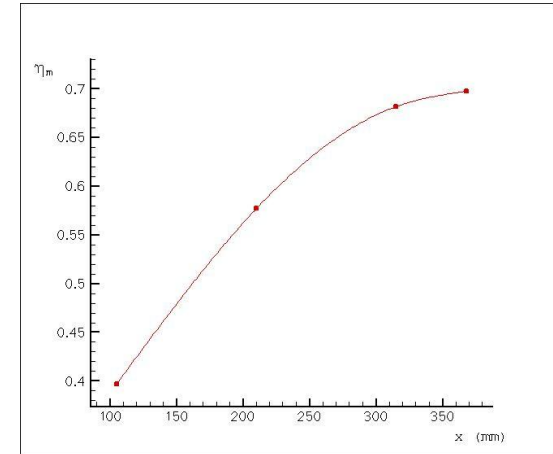
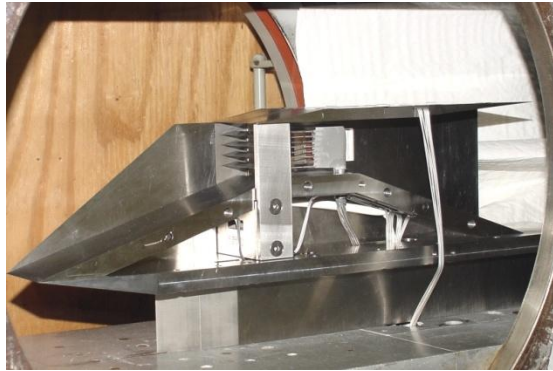
# Statistical Research and Engineering Grant Activities

- NASA PACE-“MSET Educational Grant  
1997-1999, \$300,000/3 yrs, Co-PI
- GE Fund- “GETMET” Educational Grant  
2000-2002, \$150,000/2 yrs. Co-PI
- NASA- “Aero-Propulsion Center”  
2004-2008, \$4,800,000/4yrs,  
Dr. Morris H. Morgan, III Center Director
- National Security Agency - “Statistical Data Mining  
and Analysis of Large Drifting Data Stream”  
2004-2006, \$153,000/2yrs, Co-PI
- Lockheed-Martin & Orbital Sciences  
2010-2011, \$400,00/1yr, Co-PI

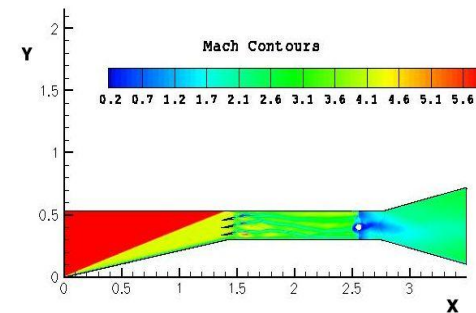
# Hampton's Aero-Propulsion Center

- Major NASA initiative to integrate statistical thinking, engineering and methods in aerospace engineering
- NASA funded project to advance research on
  - ✓ Improving Scramjet Combustion Efficiencies
  - ✓ Improving Lift to Drag Ratios of Wave-Rider Designs
  - ✓ Validating Numerical Simulations & Wind Tunnel Studies
  - ✓ Improving Signal Masking and Recovery
- Hampton Research Team
  - Engineering: M. Morgan (Diretor), D. Lyons, J. Akyurtlu  
A. Akyurtlu & V. Khaikine
  - Statistics: C. Morgan

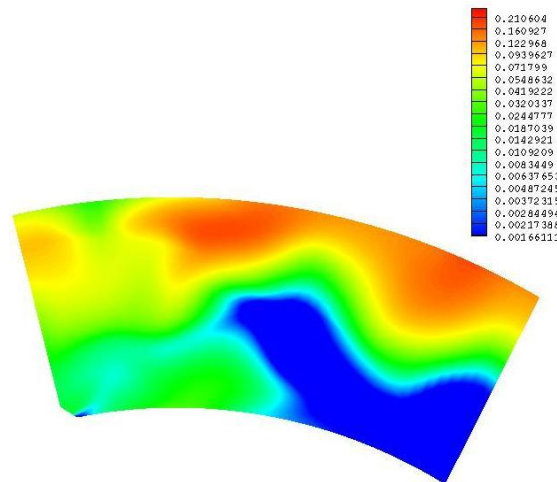
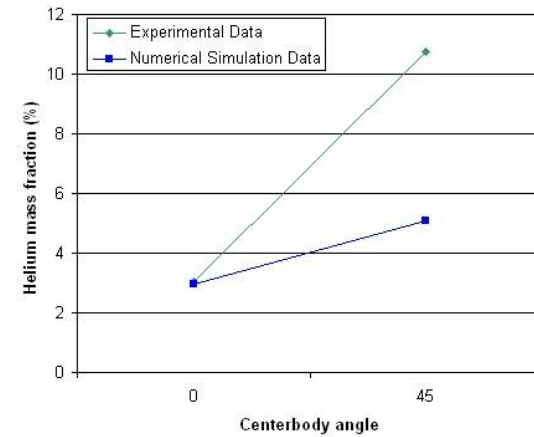
# Improving Scramjet Combustion via Pylon Modifications



Telescope Inlet with Pylons and H<sub>2</sub> Combustion  
Freestream Mach number 6

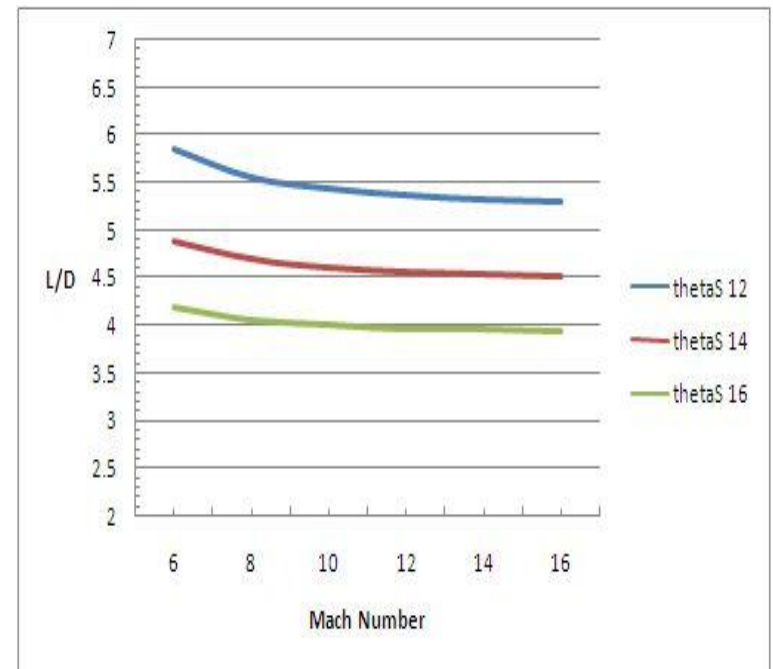
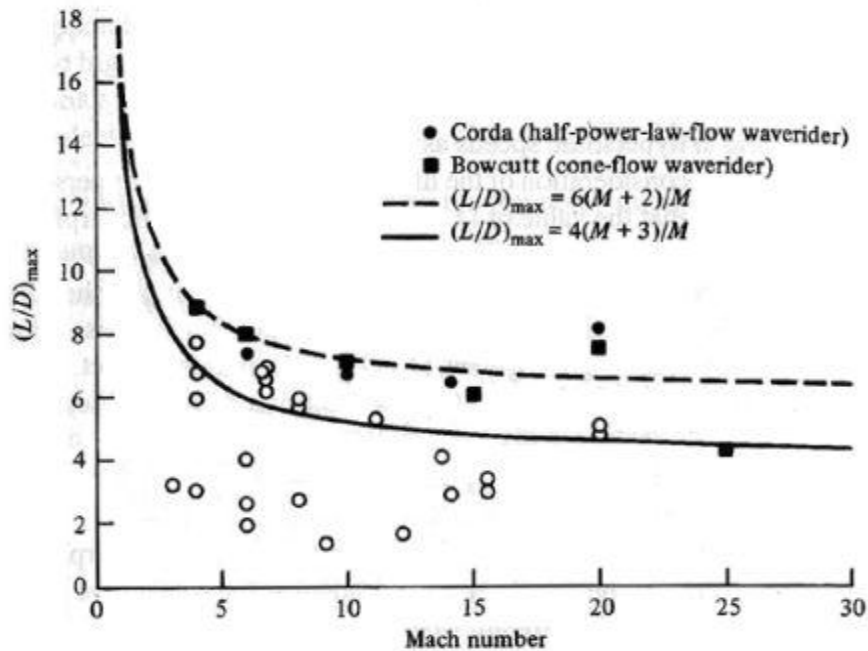


# Star-Shaped Inlet Mixing Efficiencies





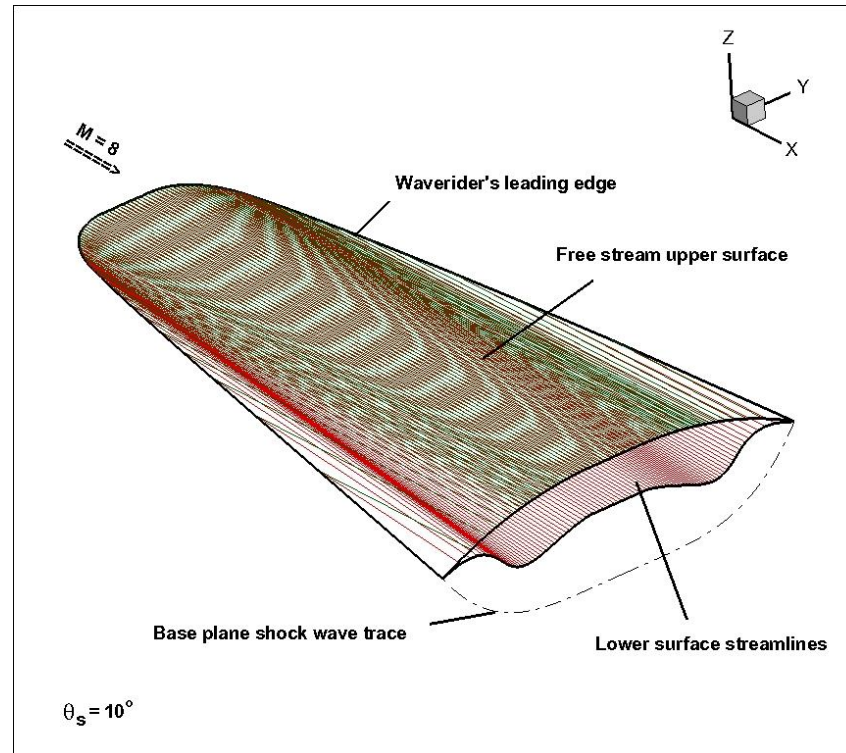
# Added Dimensional Variable in Lift/Drag Ratio



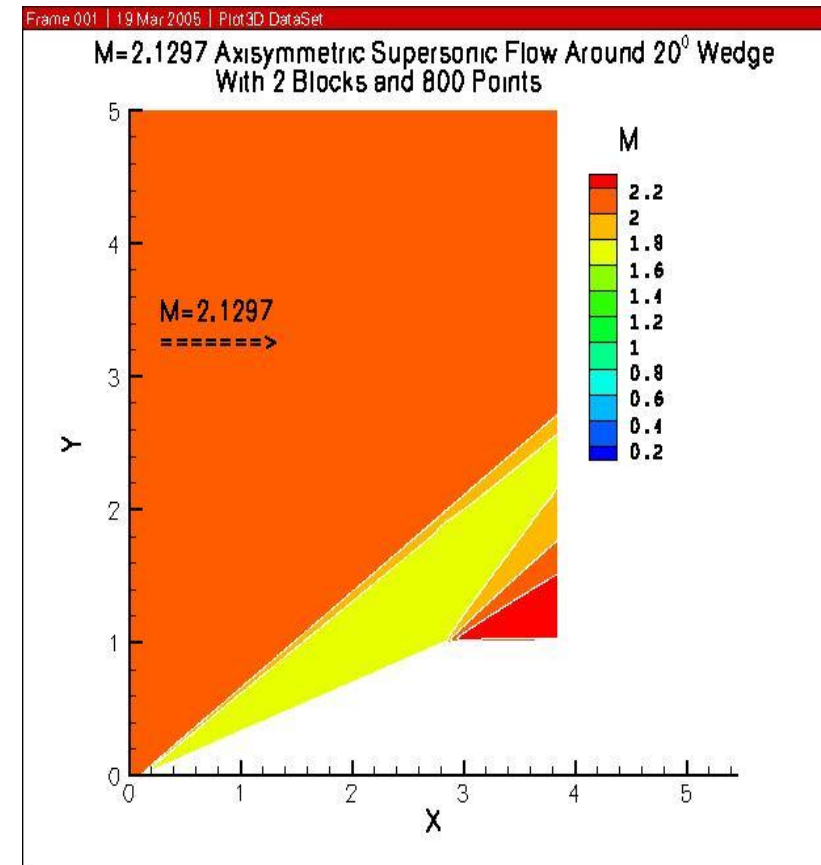
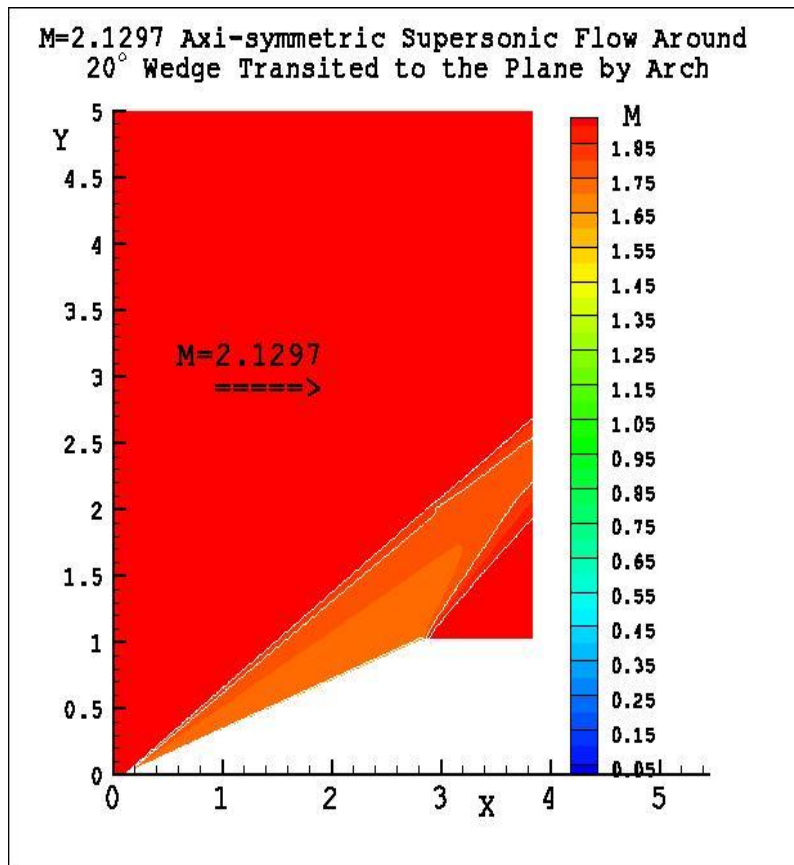
# Lockheed Martin's X-33 Design



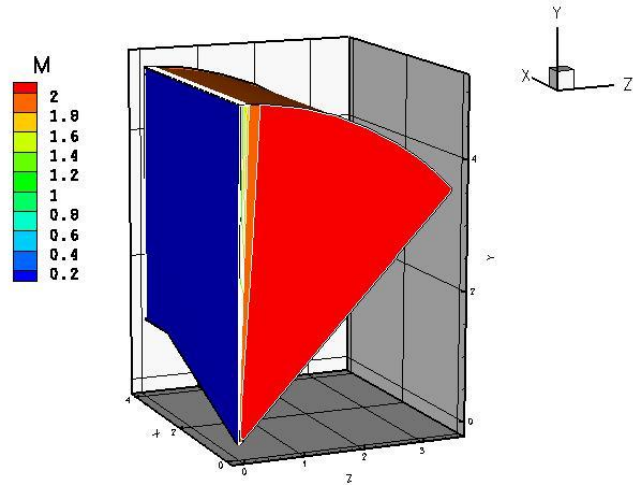
# Improving Wave-Rider Designs



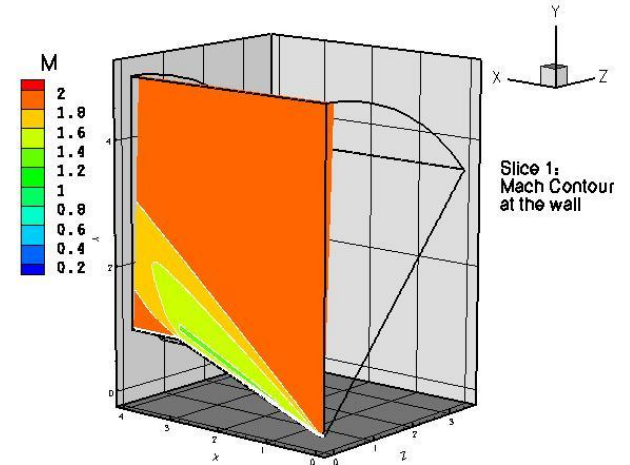
# Validating Numerical Simulation & Wind Tunnel Studies



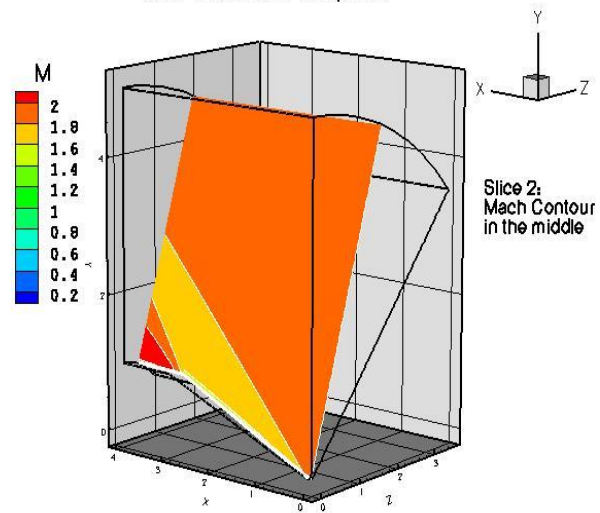
M=2 3D Case Supersonic Flow Around  $19.16^\circ$  Cone  
With 1 Block and 400 points



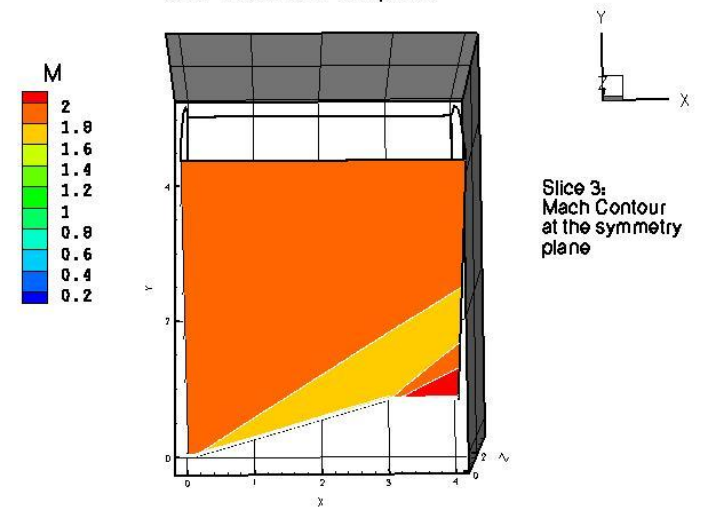
M=2 3D Case Supersonic Flow Around  $19.16^\circ$  Cone  
With 1 Block and 400 points



M=2 3D Case Supersonic Flow Around  $19.16^\circ$  Cone  
With 1 Block and 400 points



M=2 3D Case Supersonic Flow Around  $19.16^\circ$  Cone  
With 1 Block and 400 points



# Advantages of Industrial, Academic and Government Collaborations

- Key to addressing challenging problems that require interdisciplinary teams (engineers, statisticians, scientists, ...) and large resources (equipment, tools, ..)
- Provides students and faculty “outside-the-book” research experiences
- Serves to attract future students to STEM careers
- Provides funding for undergraduate and graduate research and faculty
- Yields opportunities for publications, presentations, etc.